Working Report No. 3 2000 Arbejdsrapport fra Miljøstyrelsen

Heavy Metals in Packagings - Check Analyses 1998

Ivan Kristensen

Miljøstyrelsen Miljø- og Energiministeriet

The Danish Environmental Protection Agency will, when opportunity offers, publish reports and contributions relating to environmental research and development projects financed via the Danish EPA.

Please note that publication does not signify that the contents of the reports necessarily reflect the views of the Danish EPA.

The reports are, however, published because the Danish EPA finds that the studies represent a valuable contribution to the debate on environmental policy in Denmark.

Contents

1 Introduction

2 Procedure

2.1 Purchase

2.2 Analyses

3 Results

4 Conclusion 8

Enclosures

I Registration of Samples 9 A Registration of Samples of Wine Bottles 9 B Registration of Samples of Metal Packagings 10 C Places of Purchase 11

II Enclosure from Purchase 12

1 Introduction

In 1997 the Danish Environmental Protection Agency published the report entitled: Survey of the Content of Heavy Metal in Packagings on the Danish Market, Environmental Project No. 349.

At the end of 1998 - to follow up on this project - the Danish Environmental Protection Agency has requested an analysis of a number of bottle and metal packagings for the content of the heavy metals chromium, lead, cadmium and mercury.

2 Procedure

2.1 Purchase

The packagings were purchased in the western part of Copenhagen on 23 November 1998 by Birgitte Kjær, the Danish Environmental Protection Agency, and Ivan Christensen, Danish Technological Institute, Aarhus.

Project 349 from 1997 revealed a high content of lead in soldered tins.

Therefore, an attempt was made to buy soldered tins.

However, it proved difficult to find tin packagings with soldered joints. In-

quiries at building markets (Bauhaus and Silvan), dealers in car cleaning agents, paint dealers and various hobby shops all proved negative. An explanation was also given. "It is too expensive to make anything else but tins with rolled joints".

As to this type of tins, project 349 did not show high content of heavy metals.

The purchase of tin packagings ended up with one tin of alkyd lacquer which, from a visual point of view, could be soldered, as well as two tubes of hobby colours.

Project 349 showed wine bottles with a high content of lead. To assess the lead content of the wine bottles on the market in 1998, 47 packagings in the form of wine bottles at a price of DKK 25-60 were purchased.

Two wines were bottled in Denmark whereas the rest of the wines were imported on bottles. Wine bottles imported from Argentina, Australia, Bulgaria, California, Chile, France, Greece, Italy, Portugal, Spain, South Africa, Germany and Hungary were purchased.

Rumania was not represented, but two bottles from this country were ac-

quired later.

Place of purchase, country of origin and mark of the 52 samples appear from enclosures I and II.

2.2 Analyses

The analyses for the content of the heavy metals chromium, lead, cadmium and mercury were carried out as described in project 349. The wine bottles were crushed. After crushing of the glass, a pellet was pressed of the glass powder and analysed by X-ray technique (Philips PW2400/UNIQUANT, ver. 4.14).

After the tin had been cut up, it was analysed at the joint. The X-ray analysis showed a high content of lead, and therefore, an atomic absorption spectrometry analysis was also performed after solution in a hydrochloric acid/nitric acid mixture. The result was converted to a content based on the entire tin packaging.

The tubes were cut up and analysed directly by X-ray technique (the main component was aluminium).

3 Results

I V 1820 <10	Sample No.	Type of Sample	ppm Cr	ppm Cd	ppm Hg	ppm Pb
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	1	V	1820	<10	<10	150
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	2	V	1500	<10	<10	41
4 V 990 <10 <10 <10 <50 5 V 1500 <10 <10 <10 <45 6 V 1200 <10 <10 <10 <10 7 V 340 <10 <10 <10 110 8 V 590 <10 <10 <160 160 9 V 60 <10 <10 260 11 10 V 1700 <10 <10 220 12 11 V 1700 <10 <10 100 120 14 V 1600 <10 <10 110 160 15 V 1600 <10 <10 110 10 16 V 1900 <10 <10 100 10 20 V 1300 <10 <10 300 <td>3</td> <td>V</td> <td>970</td> <td><10</td> <td><10</td> <td>29</td>	3	V	970	<10	<10	29
5 V 1500 <10 <10 <10 <46 6 V 1200 <10 <10 <10 <166 7 V 340 <10 <10 <10 <166 9 V 60 <10 <10 <160 <160 9 V 60 <10 <10 <160 <160 10 V 1700 <10 <10 $220 <12 12 V 1300 <10 <10 120 <10 120 13 V 1300 <10 <10 110 160 15 V 1600 <10 <10 110 10 16 V 1400 <10 <10 110 10 20 V 390 <10 <10 10 300 21 V 1300 <10 <10 $	4	V	990	<10	<10	50
6 V 1200 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <20 <10 <10 <20 <10 <10 <20 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 <10 </td <td>5</td> <td>V</td> <td>1500</td> <td><10</td> <td><10</td> <td>45</td>	5	V	1500	<10	<10	45
7 V 340 <10 <10 10 8 V 590 <10	6	V	1200	<10	<10	460
8 V 500 <10 <10 100 100 9 V 60 <10	7	V	340	<10	<10	110
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	8	V	590	<10	<10	160
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	9	V	60	<10	<10	160
11 V 1700 <100 <100 <200 12 V 1300 <10 <10 100 100 13 V 1300 <10 <10 100 120 14 V 1600 <10 <10 160 120 14 V 1600 <10 <10 100 110 16 V 1400 <10 <10 100 110 16 V 1400 <10 <10 110 110 17 V 1600 <10 <10 110 110 20 V 390 <10 <10 10 130 21 V 1300 <10 <10 300 22 V 1300 <10 <10 300 22 V 1300 <10 <10 200 $220 200 220 200$	10	V	1700	<10	<10	260
12 V 1300 <100 <100 <100 <100 <100 13 V 1300 <10 <10 <10 100 14 V 1600 <10 <10 110 16 V 1600 <10 <10 110 16 V 1400 <10 <10 110 16 V 1400 <10 <10 110 17 V 1600 <10 <10 110 18 V 1900 <10 <10 110 20 V 3300 <10 <10 370 21 V 1300 <10 <10 300 22 V 1300 <10 <10 300 24 V 2200 <10 <10 210 25 V 1300 <10 <10 220 29	10	V	1700	<10	<10	220
13 V 1300 <100 <100 <100 <120 14 V 1600 <10 <10 <10 120 14 V 1600 <10 <10 <10 110 15 V 1600 <10 <10 110 100 16 V 1400 <10 <10 100 110 17 V 1600 <10 <10 110 100 19 V 1800 <10 <10 110 130 21 V 1300 <10 <10 300 21 V 1300 <10 <10 300 22 V 1300 <10 <10 300 210 210 210 210 210 210 210 210 210 210 210 210 210 210 210 210 210 210 <	12	V	1300	<10	<10	100
14 V 1600 <10 <10 160 15 V 1600 <10	13	V	1300	<10	<10	120
15 V 1600 <10 <10 100 16 V 1400 <10	13	V	1600	<10	<10	160
16 V 1400 <10 <10 100 16 V 1400 <10	15	V	1600	<10	<10	110
17 V 1600 <10 <10 100 18 V 1900 <10	16	V	1400	<10	<10	100
17 1000 <100 <10 <10 <10 <10 18 V 1900 <10 <10 <10 110 19 V 1800 <10 <10 110 110 20 V 390 <10 <10 10 300 21 V 1300 <10 <10 300 22 V 1300 <10 <10 300 23 V 1300 <10 <10 300 24 V 2200 <10 <10 200 25 V 1300 <10 <10 210 26 V 1700 <10 <10 220 29 V 1300 <10 <10 220 29 V 1300 <10 <10 10 30 V 1650 <10 <10 150	17	V	1600	<10	<10	71
10 V 1200 <100 <10 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <100 <300 21 V 1300 <10 <10 <10 $300 22 V 1300 <10 <10 <10 300 23 V 1300 <10 <10 300 24 V 2200 <10 <10 210 200 25 V 1300 <10 <10 210 27 7 V 1200 <10 <10 210 27 7 V 1200 <10 <10 100 100 100 100 100 30 V 1300 <10 <10 100 150 31 V 1700 <1$	18	V	1900	<10	<10	150
19 V 1800 <100 <10 <10 110 20 V 1300 <10 <10 <10 370 21 V 1300 <10 <10 300 22 V 1300 <10 <10 300 23 V 1300 <10 <10 300 24 V 2200 <10 <10 200 25 V 1300 <10 <10 200 26 V 1700 <10 <10 210 27 V 1200 <10 <10 220 29 V 1300 <10 <10 220 29 V 1300 <10 <10 140 30 V 1700 <10 <10 150 31 V 1700 <10 <10 150 32 V	10	V	1900	<10	<10	110
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	20	V	390	<10	<10	130
21 V 1300 <10 <10 300 22 V 1300 <10 <10 300 23 V 1300 <10 <10 300 24 V 2200 <10 <10 200 25 V 1300 <10 <10 200 26 V 1700 <10 <10 210 27 V 1200 <10 <10 210 27 V 1200 <10 <10 210 27 V 1200 <10 <10 140 30 V 1300 <10 <10 140 30 V 74 <10 <10 140 31 V 1700 <10 <10 150 32 V 1200 <10 <10 170 34 V	20	V	1300	<10	<10	370
23 V 1300 <10 <10 <10 300 24 V 2200 <10 <10 300 24 V 2200 <10 <10 210 300 25 V 1300 <10 <10 210 26 26 V 1700 <10 <10 210 26 26 V 1200 <10 <10 210 220 28 V 1400 <10 <10 120 <10 120 <10 120 29 V 1300 <10 <10 140 30 V 1700 <10 <10 150 33 V 1650 <10 <10 120 34 V 1700 <10 <10 120 36 V 29 <10 <10 170	21	V	1300	<10	<10	300
23 V 1300 <10 <10 <10 200 24 V 2200 <10	22	V	1300	<10	<10	300
V 2200 <100 <10 <200 25 V 1300 <10 <10 26 26 V 1700 <10 <10 210 27 V 1200 <10 <10 210 27 V 1200 <10 <10 220 29 V 1300 <10 <10 220 29 V 1300 <10 <10 140 30 V 74 <10 <10 140 31 V 1700 <10 <10 150 32 V 1200 <10 <10 150 34 V 1700 <10 <10 120 36 V 29 <10 <10 170 38 V 1200 <10 <10 170 40 V 600	23	V	2200	<10	<10	200
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	24	V	1300	<10	<10	200
27 V 1700 <10 <10 <10 210 28 V 1400 <10 <10 220 29 V 1300 <10 <10 220 29 V 1300 <10 <10 140 30 V 74 <10 <10 64 31 V 1700 <10 <10 64 31 V 1700 <10 <10 64 32 V 1200 <10 <10 150 33 V 1650 <10 <10 150 34 V 1700 <10 <10 150 35 V 29 <10 <10 120 36 V 600 <10 <10 170 37 V 1400 <10 <10 170 38 V 1200 <10 <10 170 40 V 1300 <10 <	25	V	1300	<10	<10	20
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	20	V	1700	<10	<10	78
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	28	V	1400	<10	<10	220
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	29	V	1300	<10	<10	140
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	30	V	74	<10	<10	64
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	31	V	1700	<10	<10	150
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	32	V	1200	<10	<10	350
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	33	V	1650	<10	<10	150
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	34	V	1700	<10	<10	200
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	35	V	29	<10	<10	420
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	36	V	600	<10	<10	170
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	37	V	1400	<10	<10	170
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	38	V	1200	<10	<10	2400
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	39	V	570	<10	<10	170
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	40	V	600	<10	<10	160
11 1100 1100 1100 110 110 110 110 110 110 110 120 42 V 1300 <10 <10 <10 126 43 V 2100 <10 <10 100 180 44 V 1600 <10 <10 29 45 V 1200 <10 <10 29 46 V 300 <10 <10 110 47 V 1300 <10 <10 200 48 D $<1 *$ <10 <10 $150 *$ 49 T <10 <10 <10 50 50 T <10 <10 <10 36 51 V 1300 <10 <10 73 52 V 1600 <10 <10 37	41	V	1100	<10	<10	37
12 1300 1000 100 100 20 43 V 2100 <10 <10 180 44 V 1600 <10 <10 29 45 V 1200 <10 <10 29 46 V 300 <10 <10 110 47 V 1300 <10 <10 200 48 D $<1*$ <10 <10 $150*$ 49 T <10 <10 <10 50 50 T <10 <10 <10 36 51 V 1300 <10 <10 73 52 V 1600 <10 <10 37	42	V	1300	<10	<10	26
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	43	V	2100	<10	<10	180
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	44	V	1600	<10	<10	29
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	45	V	1200	<10	<10	29
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	46	V	300	<10	<10	110
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	47	V	1300	<10	<10	200
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	48		<1 *	<10	<10	150 *
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	49	<u> </u>	<10	<10	<10	50
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	50	T	<10	<10	<10	36
52 V 1600 <10 <10 75	51	V	1300	<10	<10	73
	52	V	1600	<10	<10	37

The results marked with *) have been found by atomic absorption spectrometry. The other results are average values of double determinations by X-ray technique. Accuracy: $\pm 1\%$ rel.

Types of Samples

V Wine bottles D Tin T Tube

4 Conclusion

To follow up on project 349 of the Danish Environmental Protection Agency: Survey of the Content of Heavy Metal in Packagings on the Danish Market 3 metal and 49 glass packagings have been analysed.

In the Packaging Directive (94/62) threshold limit values for the sum of the concentration levels of lead, cadmium, mercury and hexavalent chromium have been laid down.

During the period from 30 June 1998 to 30 June 1999, the sum of the concentrations of the 4 heavy metals must not exceed 600 ppm.

During the period from 30 June 1999 to 30 June 2001, the threshold limit value is 250 ppm.

The threshold limit value of 600 ppm is exceeded in one case.

The coming threshold limit value of 250 ppm is exceeded in eight cases.

The exceeding of the threshold limit values, which - in all cases - has been found in the glass packagings, has merely been assessed on the basis of the lead content. The values found for chromium is the total content of which the share of Cr(VI) is low.

Enclosure I

Sample No.	Origin	Mark	Type of Wine	Place of purchase
1	Chile	Sunrise, 97	Red	0
2	Australia	Hardy, Stamp 97	Red	0
3	South Africa	Sable View, 95	Red	0
4	California	Carignare,	Red	0
		Inglenook		
5	France *	Bourgogne, 96	White	0
6	Argentina	Santa Ana, 96	Red	0
7	Germany	Flonheimer	White	0
		Kabinett, 97		
8	France	Chasse du Pape,	Red	0
		Rhone, 97		
9	Italy	Castelli Romani,	White	0
		Tullio		
10	Portugal	Mateus, White	White	0
11	Portugal	Porta Nova, Vino	White	0
		Verde		
12	Spain	Solmayor,	White	0
		Mancha		
13	Spain	Priorat, 94	Red	0
14	Portugal	Chancellor	White Port	0
15	France	Parentiere, Loire,	Muscadet	0
		96		
16	Spain	Misela, Rioja, 93	White	0
17	Italy	Marsala, Sicilla	Dessert Wine	0

A Registration of Samples of Wine Bottles

18	Italy	Martini, Extra Dry	Vermouth	0
19	France	Ch. Carmeilh, Bordeaux, 96	Red	0
20	France	Ch. St. Didier- Parnac, Cahor, 95	Red	0
21	Italy	Bardolino, 95	Red	0
22	Italy	Sangiovese, Toscana, 97	Red	0
23	Italy	Salice, Pugnia, 96	Red	0
24	France	Riesling, Witz, 97	White	0
25	Bulgaria	Suhindol, 94	Red	0
26	Hungary	St. Stephans Crown, Egri, 97	Red	0
27	Greece	Nemea, Lafkioti, 93	Red	0
28	Italy	Fontana Fredda	Sparkling White	0
29	Spain	Gran Baron	Sparkling White	0
30	Italy	Lambrusco, Dell'Emilia	Sparkling Rose	0
31	France	Paul Bur	Sparkling White	0
32	Argentina	Norton, Sangiovese, 95	Red	Т
33	Chile	Carmen, 96	Red	Т
34	Hungary	St. Stephans Crown, Szekszardi, 96	Red	Т
35	Italy	Lambrusco	Sparkling Rose	F
36	California	Sutter Home, Fam. Res.	Red	F
37	Spain	Larums, Navarra, 97	White	F
38	Portugal	Charamba, 96	Red	F
39	France	Lirac, Rhone, 97	Red	F
40	Australia **	Sacred Hill, 97	Red	F
41	Bulgaria	Mavrud, Perushtitza, 93	Red	F
42	South Africa	Pinotage, 95	Red	F
43	Germany	Piesporter, Riesling, 97	White	F
44	Greece	Retsina, Boutari	White	F
45	Italy	Portapalo, Silicia	Red	F
46	Germany	Liebfraumilch, Phalz, 96	White	F
47	Spain	Torres, Coronas, 96	Red	F
51	Rumania	Galbena Odobesti, 95	Red	L
52	Rumania	Murfatlar Chardonnay 95	White	L

*) Imported and bottled by International Wine Cellars, Danmark **) Imported and bottled by Chris Wine, Danmark

B Registration of Metal Packagings

Sample No.	Origin	Mark	Place of purchase
48	Denmark	Miller's Alkyd Lak	S
		Blank, Miller & Co,	
		DK-2765 Smørum	
		(DKK 50)	
49	Holland	Tube hobby colour	R
		Holland Oil Colour,	
		Amsterdam (DKK 36)	
50	England	Tube hobby colour	R
		Winton 18 Oil Colour	
		(DKK 36.)	

C Places of Purchase

O Wine bottles bought at OBS, City 2, Taastrup

T Wine bottles bought at Taastrup Ny Vinhandel

F Wine bottles bought at Føtex, Taastrup

L Wine bottles provided in Aarhus

S Tin of alkyd lacquer bought at Sadolin, City 2, Taastrup

R Tubes with hobby colour bought at Regnbuen, City 2, Taastrup

Enclosure II

Enclosure relating to the Purchase